REMARKS

Claims 1-22 are pending in the application. The Applicants previously elected to prosecute claims 1-7 and 9-20 and claims 8, 21 and 22 were withdrawn. By this amendment, the Applicants have amended claims 1, 2, 9, 15 and 17, cancelled claims 8, 10, 12, 13 and 18-22, and added new claims 23-39. Amended claim 1 incorporates the limitations of cancelled claims 10, 12 and 13.

Support for the new claims that have been added by this amendment is found in the specification and claims of the application as follows:

New claim 23 is supported by the disclosure at page 6, lines 18-20 of the specification.

New claim 24 is supported by the disclosure at page 3, line 21 to page 4, line 8 of the specification.

New claim 25 is supported by claims 2, 3, 9 and 14 and the disclosure at page 3, line 21 to page 4, line 8 and page 6, lines 18-20 and 30-31 of the specification.

New claim 26 is supported by claim 4.

New claim 27 is supported by claim 1.

New claim 28 is supported by the disclosure at page 6, lines 30-33 of the specification.

New claim 29 is supported by claim 1.

New claim 30 is supported by the disclosure at page 6, lines 30-33 of the specification.

New claim 31 is supported by claim 18.

New claim 32 is supported by claim 18; the disclosure at page 6, lines 9-11 and 18-20 of the specification; and Figure 1.

New claim 33 is supported by the disclosure at page 6, lines 15 to 17 of the specification.

New claim 34 is supported by claim 19.

New claim 35 is supported by claim 20.

New claim 36 is supported by claims 13 and 19.

New claim 37 is supported by claims 12 and 20.

New claim 38 is supported by claim 18.

One of the main advantages of the present invention is that the graphic design elements of a ski can be maintained over a long period even with extensive use, which cannot be attained by the previously known processes. This unexpected result is attributed to the construction, which includes a multilayer film comprising a multilayer transfer film or multilayer laminating film comprising several different thin layers. One of ordinary skill in the art is aware of how difficult it is to obtain good adhesion between thin layers of different materials due to the problem of delamination between adjacent thin layers. In the present invention, the multilayer transfer film or multilayer laminating film has to link the cover layer to the mechanically load bearing layer permanently to assure the structural integrity of the multilayer film. Therefore, it was surprising to find that – particularly in view of the fact that the multilayer film on a ski is usually bent and significantly distorted during manufacture – the multilayer film withstands the mechanical load when the ski is used without delamination of the interior layers causing damage to the optical appearance of the ski or failure of the ski.

The thickness of the cover layer is chosen so that, on the one hand, the cover layer is able to protect the multilayer transfer film or multilayer laminating film from damage (e.g. due to

scratching) and, on the other hand, it is able to adhere to the multilayer transfer or laminating film permanently without any delamination. A thickness of the cover layer of between 50 – 125 μm (as claimed) provides these features when the cover layer is adhered to one side of the multilayer transfer film or multilayer laminating film and the load bearing layer is adhered to the other side. Part of the reason for this is the flexibility of a cover layer of such a thickness.

The Applicants would like to clarify the meaning of the term "thin layers" as used in the claims. The present application is based on a PCT application that was originally filed in the German language and an English translation was filed in the present application. In the German language application, the term "Dünne Schichten" was used. The German term "Dünne Schichten" has a specific meaning that is known to those of ordinary skill in the art and that can be found in any technical encyclopedia. The Applicants are attaching a copy of page 1051 of a German language encyclopedia for chemistry called "RÖMPP Chemie Lexikon," which defines "Dünne Schichten" as a thin layer having a layer thickness up to 10 μm. When the German language application was translated, the term "thin layers" was determined to be an appropriate translation of the German term "Dünne Schichten." This is further supported by the definition in Wikipedia which is also attached hereto.

One of ordinary skill in the art would know that the prior art films similar to the multilayer films in the claims have experienced delamination problems. The films claimed by the Applicants have overcome these delamination problems and are new and inventive with regard to a combination of the cited references. For these reasons, the claims are patentable over the prior art.

Applicants have carefully considered the specific issues raised in the October 3, 2007 Office Action and respond as follows:

Claim Rejections - 35 USC § 112

Claim 15 has been rejected under 35 U.S.C. 112 as indefinite based on a finding that the phrase "in particular a casting lacquer..." is narrower than range/limitation. The Applicants have amended claim 15 and deleted this objectionable phrase.

Claim Rejections - 35 USC § 103

Claims 1-4, 10-11, 16 and 18-20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,690,349 to Rohrmoser ("Rohrmoser") and U.S. Patent No. 2,858,248 to Hastings III ("Hastings").

Rohrmoser discloses a process for manufacturing a ski comprising a U-shaped multilayer shell and a core (6). The shell comprises a cover ply (12) and a reinforcement layer (13). The reinforcement layer (13) is disposed between the cover ply (12) and the core (6). There is no teaching or suggestion that the shell comprises a multilayer transfer film or a multilayer laminating film having a thickness of less than 125 μm and comprising two or more thin layers. Further, Rohrmoser does not disclose that the cover ply and/or the reinforcement layer is/are transparent and have a specified thickness with regard to such a multilayer transfer film or a multilayer laminating film.

At page 3 of the Office Action, the Examiner has found that Rohrmoser teaches a core (6) that is equivalent to the mechanically load-bearing layer of the multilayer film in claim 1 and a

cover layer (12) that is equivalent to the cover layer in claim 1. Claim 1 requires a "multilayer transfer film or multilayer laminating film of a thickness of less than 125 μm and comprising two or more thin layers" to be disposed between the cover layer and the mechanically load-bearing layer. FIG. 2 of Rohrmoser teaches a reinforcement layer (13) between the cover layer (12) and the core (6). Thus, Rohrmoser's reinforcement layer (13) is disposed between the cover layer (12) and the core (6) and not on the surface of the multilayer transfer film or multilayer laminating film as required in claim 1.

The Examiner has also found at page 3 of the Office Action that it would be obvious to substitute the laminated flexible sheet material taught by Hastings for the reinforcement layer (13) in Rohrmoser. Hastings discloses a laminated flexible sheet material comprising a base sheet of leather, cloth, paper or the like covered with a uniform adhesive layer and a decorative metallized film. Col. 1, lines 15-20. The metallized film comprises a transparent polyester film of a thickness of between 0.1 and 0.5 mil (2.54 to 12.7 μm), which is vacuum coated with a thin layer of metal. The metal side of the polyester film is adhered to the base sheet by the adhesive layer. Col. 2, lines 1-15. Hastings teaches that the object of the invention is to protect gold coated leather articles so that the gold does not rub off. Col. 1, lines 26-33. Hastings accomplishes this objective by covering the metal coated leather article with the layer of polyester film.

At page 3 of the Office Action, the Examiner states that:

> It would have been obvious to one of ordinary skill in the art to take the teachings of Hastings III et al. and incorporate them into the invention of Rohrmoser in

> order to provide a multilayer laminating film to provide to provide a durable assembly resistant to wear.

The combination of Rohrmoser and Hastings suggested by the Examiner would substitute the laminated flexible sheet material taught by Hastings for the reinforcement layer (13) of Rohrmoser. Rohrmoser teaches at col. 4, lines 58-65 that the reinforcement layer (13) is used to relieve stress on a ski:

> Skis which are very much stressed, in particular racing skis, can have a bottom strap with a **reinforcement layer, for example of aluminum, a titanium-aluminum alloy, fiberglass, carbon, ceramic or steel sheet**, with spacers keeping a distance between the running surface layer and the reinforcement layer. This provides a solid reinforcement in the area of the running surface of the ski. (Emphasis added.)

One of ordinary skill in the art of making skis would not substitute a metal coated leather sheet with a protective polyester layer for the reinforcement layer (13) in Rohrmoser. Rohrmoser teaches that the reinforcement layer can be "aluminum, a titanium-aluminum alloy, fiberglass, carbon, ceramic or steel sheet." A metal coated leather sheet with a protective polyester layer would not be an obvious or suitable substitute for such materials. Moreover, Hastings teaches that the metal film is used as a "decorative metallized coating" (col. 1, line 45) and has a "microscopic thickness" (col. 2, line 61) so that "the metal film is just thick enough that the light transmission of the film is on the order of a few percent" (col. 2, lines 61-63). One skilled in the art would not substitute the laminated sheet material taught by Hastings for the reinforcement layer (13) of Rohrmoser because the microscopically thin metal layer in Hastings (between 0.1 to 0.5 mils) would not provide the "solid reinforcement" required by Rohrmoser.

A combination of Hastings III et al. and Rohrmoser does not lead to amended claim 1 of the present application, as there is no motivation for someone of ordinary skill in the art to arrange the metallized film of Hastings III et al. in between the cover ply (12) and the reinforcement layer (13) of Rohrmoser. Rohrmoser does not disclose a transparent cover ply or a transparent reinforcement layer. Therefore, it would not make any sense to arrange the decorative metallized film of Hastings III et al. in between these two layers because the decorative metallized film would not be visible. Furthermore, there is no teaching or suggestion that the polyester film of Hastings III et al. could or should be covered by a further layer.

With regard to claim 2, the Examiner has found that the adhesive layer, functional layer and release layer of claim 2 is taught by Hastings and that the polyester film layer (13) in Hastings is a release layer. One skilled in the art would know that a release layer is a layer that can be easily separated from an adjacent layer. Hastings teaches that, "The number 12 designates a metal film vacuum-metallized to an external polyester film 13. The metal 12 is uniformly and continuously adhered to the adhesive layer 11." Col. 2, lines 1-4. One skilled in the art would not choose to vacuum metallize a release layer since a person skilled in the art would know that the polyester film layer (13) cannot be easily separated from the vacuum coating of metal.

Hastings teaches that the object of his invention is to protect leather articles decorated with metal so that the metal does not wear off over time (col. 1, lines 26-29). Moreover, Hastings teaches that "an object of [the] invention [is] to prepare a laminated flexible sheet material the laminations of which are **uniformly and permanently adhered together.**" Col. 1,

lines 41-43. (Emphasis added.) Accordingly, the finding that the polyester layer (13) of Hastings can be used as a release layer is directly contrary to the teachings of Hastings and the Applicants respectfully request that this rejection be withdrawn.

With regard to claim 3, the Examiner has found that the polyester film layer (13) in Hastings, which the Examiner has found to be a release layer, can be a clear lacquer layer. As discussed above with regard to claim 2, Hastings clearly teaches that the polyester layer (13) is "uniformly and permanently" adhered to the other layers of the sheet material. Col. 1, lines 43. Accordingly, whether or not the polyester layer (13) in Hastings is clear, it still is not a release layer and does not render claim 3 obvious. The Applicants respectfully request that the rejection of claim 3 be withdrawn.

With regard to claim 4, the Examiner has found that the metal layer (12) in Hastings is the same as the metal layer in claim 4. Claim 4 depends on claim 2 which requires the multilayer transfer film or multilayer laminating film to have a release layer. As discussed above with regard to claims 2 and 3, Hastings does not teach a sheet material with a release layer. Accordingly, claim 4 is not obvious and the Applicants respectfully request that the Examiner withdraw the rejection of claim 4.

With regard to claims 10, 11, 16, 18, 19 and 20, claims 10 and 18-20 have been cancelled by this amendment. Claims 11 and 16 are not obvious for the same reasons as stated above for claims 1-3.

Claim 5 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Rohrmoser in view of Hastings and further in view of U.S. Patent No. 6,210,777 to Vermeulen et al. ("Vermeulen"). Vermeulen discloses a security document having a transparent or translucent support and at least one layer containing interference pigments. Abstract. Vermeulen has been cited in the Office Action for disclosing a functional layer having a thin film layer succession that produces color shifts by means of interference. The Examiner has found at page 6 of the Office Action that, "it would have been obvious to one of ordinary skill in the art to take the teachings of Vermeulen et al. and incorporate them into the invention of Rohrmoser in order to provide a specific type of design on the runner board."

Claim 5 of the present application does not disclose a functional layer comprising interference pigments but, instead, discloses a functional layer comprising a thin film layer succession which produces color shifts by means of interference, which is a staple of full area thin layers. See page 10 of the specification of the application, lines 5-32, regarding such a thin film layer succession.

In rejecting claim 2, the Examiner found that the functional layer in the claims is taught by the metal layer (12) in Hastings. The Examiner now finds it obvious to substitute the layer(s) with interference pigments taught by Vermeulen for the metal layer in Hastings. There is no teaching or suggestion in Hastings for such a substitution. On the contrary, Hastings teaches against such a substitution. Hastings discloses that "the invention concerns a flexible base material covered with an adhesive internally metallized polyester film" (col. 1, lines 18-20) and that, "the metal film is just thick enough that the light transmission of the film is on the order of a

few percent, preferably not more than 2½%" (col. 2, lines 61-64). In contrast, Vermeulen discloses that, "By 'transparent or translucent support' in the document according to the present invention has to be understood a support having a visible light-blocking capacity less than 80%, preferably less than 50%, not being excluded supports that are inherently colored or have obtained a color by incorporation of colorants." Col. 2, lines 48-53. Thus, Hastings requires a metal layer (12) with a light transmission of "preferably not more than 2½%" (i.e., a visible light-blocking capacity of more than 97½%), while Vermeulen requires "a visible light-blocking capacity less than 80%, preferably less than 50%." Therefore, Hastings teaches against a substitution and there would be no motivation for one skilled in the art to substitute the substantially transparent layer taught by Vermeulen for the substantially non-transparent metal layer (12) taught by Hastings. Accordingly, the Applicants respectfully request that the rejection of claim 5 be withdrawn.

Claim 6 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Rohrmoser in view of Hastings and further in view of U.S. Patent No. 5,492,370 to Chatwin et al. ("Chatwin"). Chatwin has been cited for disclosing a functional layer with a replication layer into which a diffractive structure or a macrostructure is embossed. The Examiner has found with respect to claim 2 that the metal layer (12) taught by Hastings is the same as the functional layer in claim 2. The Examiner now finds that the replication layer in Chatwin can be substituted for the metal layer (12) in Hastings. There is no teaching or suggestion in either Hastings or Chatwin for such a substitution. Moreover, the metal layer (12) in Hastings is too thin for embossing a diffractive structure or microstructure onto it, as required by Chatwin.

The Examiner has found at page 7 of the Office Action that, "it would have been obvious to one of ordinary skill in the art to take the teachings of Chatwin et al. and incorporate them into the invention of Rohrmoser." The Applicants respectfully submits that such a substitution mischaracterizes the structure in Rohrmoser and the thin metal layer of Hastings. The rejection requires the embossed diffractive structure or macrostructure in Chatwin to be substituted for the metal layer (12) in the laminated sheet material taught by Hastings and then for the laminated sheet material taught by Hastings as modified by Chatwin to be substituted for the reinforcement layer (13) in Rohrmoser. None of the references teach or suggest such substitutions and they would not be obvious to one of ordinary skill in the art.

Claim 7 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Rohrmoser and Hastings and further in view of U.S. Patent No. 6,008,581 to Ochiai et al. ("Ochiai"). Ochiai has been cited for disclosing a functional layer that has a high refractive index ("HRI") layer. Similar to the arguments made above relating to the rejection of claim 6 based on Chatwin, the present rejection is based on the Examiner's finding that it would have been obvious to substitute the HRI layer of Ochiai for the metal layer (12) of Hastings and then substitute the modified laminated sheet material in the structure taught by Rohrmoser.

The HRI layer taught by Ochiai is part of a multi-layer anti-reflection film. Col. 7, lines 29-36. One of ordinary skill in the art would not find it obvious to substitute an anti-reflection layer for the decorative metal layer (12) in Hastings. The purpose of a decorative metal layer is to form a decoration that can be viewed when light is reflected by the metal. Substituting an anti-reflection film defeats the purpose of the decorative layer. Accordingly, Hastings teaches

away from the substitution of the anti-reflection film in Ochiai for the metal layer (12) and the Applicants respectfully request that this rejection be withdrawn.

Claim 9 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Rohrmoser in view of Hastings and further in view of U.S. Patent No. 5,589,275 to Breitler et al. ("Breitler"). Breitler has been cited for disclosing that the transfer or laminating film is deep-drawable. The Examiner has found at page 7 of the Office Action that, "it would have been obvious to one of ordinary skill in the art to take the teachings of Breitler et al. and incorporate them into the invention of Rohrmoser." However, there is no explanation of how Hastings is combined with these two references. Hastings teaches a laminating sheet material in which one layer is leather cloth or paper; materials which one skilled in the art would not find to be "deep drawable." Claim 9 requires the multilayer transfer film or multilayer laminating film to be deep-drawable. Accordingly, one of ordinary skill in the art would not find it obvious to substitute the deep drawable film taught in Breitler for one of the layers in Hastings and the applicants respectfully request that the rejection of claim 9 be withdrawn.

Claims 12-15 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Rohrmoser in view of Hastings and further in view of U.S. Patent No. 5,437,755 to Lavorel et al. ("Lavorel"). Lavorel discloses a process for decorating the top portion of a ski. An external thick layer of a thickness greater than 0.5 mm made of transparent plastic material is fixed to an opaque internal layer. A first decoration is applied to the external surface of the external layer and a second decoration is applied in between the external layer and the internal layer. However, Lavorel does not disclose an embedded multilayer transfer film or multilayer laminating film of a

thickness of less than 125 μm and comprising two or more thin layers between the thick external layer and the opaque internal layer. Moreover, Lavorel does not disclose that the external layer is of a thickness of between 50 and 125 μm and the internal layer is a mechanically load-bearing layer of a thickness of between 100 μm and 2 mm. Accordingly, Lavorel does not overcome the deficiencies of Rohrmoser and Hastings discussed above with regard to claim 1 and the Applicants respectfully request that this rejection be withdrawn.

Claim 17 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Rohrmoser in view of Hastings and further in view of U.S. Patent No. 5,944,335 to Riepler ("Riepler"). Riepler discloses a ski (1) comprising a U-shaped shell (8) which carries a multilayered cover layer (9) comprising several layers (e.g. a design layer, a transparent protection layer). Claim 17 requires additional decorations to be printed on the multilayer transfer film or multilayer laminating film, not the cover layer (9) as taught by Riepler (col. 4, lines 57-59).

Riepler does not disclose an embedded multilayer transfer film or multilayer laminating film of a thickness of less than 125 μm and comprising two or more thin layers between a (transparent) cover layer of a thickness of between 50 and 125 μm and a (transparent) mechanically load-bearing layer of a thickness of between 100 μm and 2 mm. Accordingly, Riepler does not overcome the deficiencies of Rohrmoser and Hastings discussed above with regard to claim 1 and the Applicants respectfully request that this rejection be withdrawn.

Additional Claims Fee

The Applicants have added dependent claims 23-39 by this Amendment. The original application contained a total of 22 claims. By this Amendment, 9 claims have been cancelled; leaving a total of 30 claims pending in the application (one independent claim and 29 dependent claims). Since the Applicants have already paid the fee for 22 claims, an additional fee is due for eight dependent claims. Accordingly, a $400.00 fee for the eight additional dependent claims (i.e., $50.00 per claim) is due. The Commissioner is hereby authorized to charge the $400.00 fee for the additional claims to Deposit Account No. **08-2461**.

Conclusion

The Applicants respectfully submit that the amendments to the claims and the arguments made herein have distinguished the cited references from the present invention and request early allowance of the claims. If the Examiner has any questions or comments relating to this Response, the Examiner is respectfully invited to contact Applicants' attorney at the telephone number provided below.

Respectfully submitted,

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Thin film

From Wikipedia, the free encyclopedia

Thin films are thin material layers ranging from fractions of a nanometre to several micrometres in thickness. Electronic semiconductor devices and optical coatings are the main applications benefiting from thin film construction. Some work is being done with ferromagnetic thin films as well for use as computer memory.

Ceramic thin films are also in wide use. The relatively high hardness and inertness of ceramic materials make this type of thin coating of interest for protection of substrate materials against corrosion, oxidation and wear. In particular, the use of such coatings on cutting tools may extend the life of these items by several orders of magnitude.

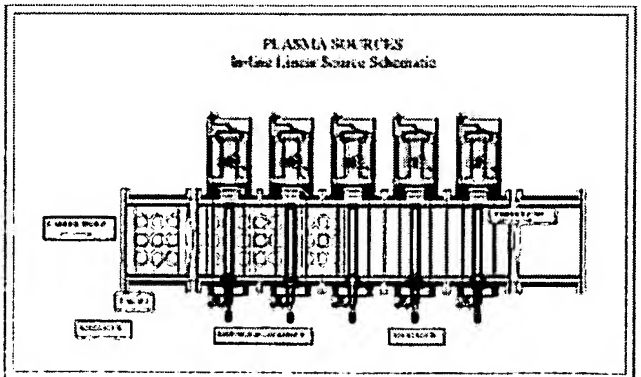
Thin-film technologies are also being developed as a means of substantially reducing the cost of photovoltaic (PV) systems. The rationale for this is that thin-film modules are expected to be cheaper to manufacture owing to their reduced material costs, energy costs, handling costs and capital costs. However, thin films have had to be developed using new semiconductor materials, including amorphous silicon, copper indium diselenide, cadmium telluride and film crystalline silicon. In all cases, these technologies face major technical and financial hurdles.

The engineering of thin films is complicated by the fact that their physics is in some cases not well understood. In particular, the problem of dewetting may be hard to solve, as there is ongoing debate and research into some processes by which this may occur.

Contents

High precision thin film deposition on large substrates

One of the major barriers met in thin film deposition is the ability to coat large dimension substrates whilst obtaining high precision results with mono or multi-layer deposition. The HiTUS plasma sputter deposition technology together with the Linear Target technology has demonstrated major improvements in desired results such as precision, uniformity, stress control from compressive to tensile with zero in between, and roughness on substrates measuring up to and over and above 50 to 60 cm. The Linear Target also enables the development of a large area linear process with the same advantages as HiTUS for roll-to-roll or in-line



Schematic of Linear Target technology

processes.

Techniques

- Thin-film deposition in CBD (Chemical Bath Deposition) method
- Physical vapor deposition (PVD)
  - Thermal Evaporation
  - Electron Beam deposition
  - Sputtering
  - Pulsed laser deposition
  - Cathodic Arc Deposition
- Chemical vapor deposition
  - Plasma Enhanced Chemical Vapor Deposition (PECVD)
  - Atomic Layer Deposition (ALD)
- Molecular beam epitaxy
- Sol-Gel Process
- Spin coating

Metallo-organic decomposition (MOD)

See also

- Thin-film deposition
- Thin-film optics
  - Dispersion (optics)
- Thin-film transistor
- Thin film memory
- Scratch tester, a method of testing thin film adhesion
- Calo tester, a method of measuring thin film thickness
- Pin on disc tester, a method of testing friction and wear resistance of thin films
- Thin liquid film, a liquid of small height flowing on a surface

External links

- MAT-VAC Technology, Inc.
- THINFILMS Inc.
- Semiconsoft, Inc. (software and hardware)
- Thin film article at Hyperphysics
- HiTUS - High Target Utilisation Sputtering
- Linear Target Technology
- European Society of Thin Films
- Ceimig - Thin Film Catalysts

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Categories: Semiconductors | Materials science | Solar energy | Thin films

for details.)

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Außerdem ist der Anfall an Wirtschaftsdüngern zu gering, um einen größeren Beitrag zur Bewältigung der *Ernährungs-Probleme der Zukunft liefern zu können. Bei Verzicht auf den Handelsdünger würden die Ernten in wenigen Jahren stark absinken. Auf Grund der Einführung der Handesldünger, einer verbesserten Schädlingsbekämpfung u. der Verw. hochwertigen Saatguts haben sich in Deutschland z. B. die Hektarerträge im Weizen- wie im Kartoffelanbau in den letzten hundert Jahren mehr als vervierfacht. Der Verbrauch an Düngemitteln erhöhte sich im Bereich der BRD von 1945–1988 nochmals um ca. 450%, insbes. bei Stickstoffdüngern; der Verbrauch an Phosphat- u. Kalidünger dagegen ist seit 1982 rückläufig. Die Rentabilität der D. ist in der Regel stets sichergestellt, denn der durch D. erzielte Mehrertrag übertrifft die Ausgaben für Düngemittel u. Arbeitslöhne bei weitem. Natürlich soll damit keineswegs der Wirtschaftsdünger ausgeschaltet werden. Neben seiner Nährstoffwirkung regt er das Bakterienwachstum an (zur Mikrobiologie des *Bodens s. dort), fördert die *Humus-Bldg. u. beeinflußt die physikal. Bodenbeschaffenheit oft in günstiger Weise. Als Lieferant für Phosphor-, Kali- u. Stickstoff-Verb. reicht er aber infolge seines hohen Prozentsatzes an „unverdaulichen" Bestandteilen nicht aus; hier müssen die Mineraldünger einspringen.

In der Sicherstellung des künftigen Nahrungsmittelbedarfs der Erdbevölkerung fällt der D. nicht nur zur Erschließung neuer Anbauflächen bes. in der Dritten Welt (gegenwärtig wird nur etwa ein Zehntel der festen Erdoberfläche landwirtschaftlich genutzt!), sondern vor allem zur noch effektiveren Nutzung der schon erschlossenen Gebiete eine wichtige Aufgabe zu. Einige Aspekte der Forschung auf dem D.-Sektor sind die Entwicklungen neuer D.-Techniken, z. B. der *Flüssigdüngung* (in den USA wurden z. B. 1973 ca. 27% des gesamterzeugten flüssigen NH_3 direkt zur D. genutzt), der sog. *Blattdüngung* (Versprühen verd. Lsg. von lösl. Düngemitteln auf die Blätter von Kulturpflanzen, ggf. in Kombination mit *Pflanzenschutzmitteln) od. der Entwicklung neuartiger *Depotdünger* (s. Düngemittel). – *E* fertilization – *F* engraissement – *I* concimazione, fertilizzazione – *S* fertilización, abonado. → Bd. 8.

Lit.: s. Düngemittel, Agrikulturchemie, Boden etc.

Dünne Schichten. Unspezif. Bez. für zusammenhängende Materieschichten, deren – z. B. durch *Ellipsometrie meßbare – Dicke von Moleküldurchmesser (*monomolekulare Schichten u. *Membranen) bis etwa 10 µm reicht; Schichten größerer Abmessungen nennt man *Filme u. *Folien. D. S. werden in Hochvakuumapparaturen durch *Gasphasenabscheidung (engl. Chemical Vapor Deposition, CVD) od. durch Aufdampfen erzeugt. Hierbei wird oft ein Plasma miteingesetzt, um z. B. durch Kathodenzerstäubung Materialien mit hoher Schmelztemperatur aufdampfen zu können od. durch Ionenbeschuß Schichten zu härten u. zu glätten (*Lit.*[1]). Die Technologie d. S. wird heute viel angewendet bei der Herst. von elektr. Widerständen, Solarzellen (s. amorphes Silizium), in der Elektrooptik sowie in der Lichtoptik (Herst. hochwertiger Spiegel, Reflex- u. Antireflexbeschichtungen, was auf großen Glasflächen aufgetragen sogar Auswirkungen auf die Architektur moderner Gebäude hat), in der Tribologie (Verschleiß) u. in der Informationsspeicherung (*Lit.*[2]). – *E* thin films – *F* couches minces – *I* strati sottili – *S* capas delgadas

Lit.: [1] Frey u. Kienel, Dünnschichttechnologie, Düsseldorf: VDI Verl. 1987. [2] Statusseminar 1988, Dünnschichttechnologie, Düsseldorf: VDI Technologie-Zentrum 1988.

allg.: Annu. Rev. Mater. Sci. **9**, 341–372 (1979) ▪ Barlow, Langmuir-Blodgett Films, Amsterdam: Elsevier 1980 ▪ Coutts, Active and Passive Thin Film Devices, London: Academic Press 1978 ▪ Deryagin, Surface Forces in Thin Films and Disperse Systems (Res. Surface Forces 4), New York: Plenum 1975 ▪ Dupuy, Physics of Nonmetallic Thin Films, New York: Plenum 1976 ▪ Eckertova, Physics of Thin Films, New York: Plenum 1978 ▪ Hamann, organische Festkörper u. organische dünne Schichten, Leipzig: Teubner 1979 ▪ Iliuc, Tribology of Thin Layers, Amsterdam: Elsevier 1980 ▪ Kazmerski, Properties of Polyerystalline and Amorphous Thin Films and Devices, New York: Academic Press 1980 ▪ Lehmann, Chemical Vapor Deposition, Springfield: NTIS 1975 ▪ Lewis u. Anderson, Nucleation and Growth of Thin Films, London: Academic Press 1979 ▪ Lüder, International Conference on Thin- and Thick-Film Technology, Berlin: VDE 1977 ▪ Mark, Thin Film Symposium 1978 [J. Vacuum Sci. Techn. **16**, 113–832 (1979)], New York: Am. Vac. Soc. 1979 ▪ Mayer, Physik dünner Schichten (2 Tl.), Stuttgart: Wiss. Verlagsges. 1972 ▪ Poate u. Mayer, Thin Films: Interdiffusion and Reactions, New York: Wiley 1978 ▪ Suchet, Les couches minces et leurs applications, Paris: Masson 1975 ▪ Ullmann (4.) **10**, 257 ff. ▪ Vakuumaufdampftechnik, Düsseldorf: VDI 1976 ▪ Vossen u. Kern, Thin Film Processes, New York: Academic Press 1978 ▪ Yarwood, Vacuum and Thin Film Technology, Oxford: Pergamon 1978 ▪ s. a. Aufdampfen, Grenzflächen u. a. Textstichwörter, ältere *Lit.* s. dort in der 7. Aufl. dieses Werkes. – *Serie:* Physics of Thin Films, New York: Academic Press (seit 1963).

Dünnsäure. Sammelbegriff für saure Produktionsabwässer, die als Hauptbestandteil ca. 20%ige Schwefelsäure enthalten u. bei verschiedenen Fabrikationsprozessen anfallen. Der bedeutendste Anteil D. entsteht bei der *Titandioxid-Produktion. Der dazu meist verwendete Rohstoff, *Ilmenit, wird mit konzentrierter Schwefelsäure aufgeschlossen; dabei geht das im Ilmenit gebundene Titan als Sulfat in Lsg. u. das ebenso gebundene Eisen fällt als *Grünsalz ($FeSO_4 \cdot 7\ H_2O$) aus. Anschließend wird das gelöste Titansulfat mit Wasser hydrolysiert u. als Titandioxidhydrat ausgefällt, dabei entsteht D.

Weiter entsteht D. bei der Produktion verschiedener org. Zwischenprodukte u. Farbstoffe. Hierbei werden org. Verb. mit konz. Schwefelsäure behandelt (z. B. bei der Sulfierung von *Anthrachinon od. anderen Benzol- u. Naphthalin-Deriv.). Neben Schwefelsäure enthält diese D. geringe Mengen org. Bestandteile.

Verfahren zur Aufarbeitung u. Aufbereitung dieser Abfallsäuren werden unter *Recycling besprochen. Darüber hinaus wurden sowohl bei der Titandioxid- als a. bei der org. Zwischenprodukt- u. Farbstoff-Produktion Verfahren entwickelt, D. nicht od. in geringeren Mengen anfallen zu lassen. – *E* spent acid – *F* acide dilué – *I* acido rarefatto – *S* ácidos residuales, aguas sulfúricas residuales. → Bd. 8.